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ABSTRACT

The Air Force uses a standardized costing methodology for resident technical training schools (TTS); no comparable methodology exists for computing the cost of on-the-job training (OJT). This study evaluates three alternative survey methodologies and a number of cost models for estimating the cost of OJT for airmen training in the Administrative Specialty (702X0) from the 1-level (helper) to the 3-level (semi-skilled). The final costing methodology selected for use in the next phase of this research effort can easily be adapted to other Air Force specialties and skill levels. The quality of OJT and TTS graduates is compared according to several criteria, and the evidence indicates that neither type of training is superior to the other for the Administrative Specialty. The cost per graduate of OJT for this specialty was estimated to be significantly below the cost of TTS. However, it is important to consider other factors in addition to cost prior to drawing any inferences concerning the optimal OJT/TTS mix. The effect of these factors is discussed at length in this report. (Author)

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THE DEVELOPMENT OF A METHODOLOGY FOR ESTIMATING THE COST OF AIR FORCE ON-THE-JOB TRAINING

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The Air Force uses a standardized costing methodology for resident technical training schools (TTS); no comparable methodology exists for computing the cost of on-the-job training (OJT). This study evaluates three alternative survey methodologies and a number of cost models for estimating the cost of OJT for airmen training in the Administrative Specialty (702X0) from the 1-level (helper) to the 3-level (semi-skilled). The final costing methodology selected for use in the next phase of this research effort can easily be

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adapted to other Air Force specialties and skill levels. The quality of OJT and TTS graduates is compared according to several criteria, and the evidence indicates that neither type of training is superior to the other for the Administrative Specialty. The cost per graduate of OJT for this specialty was estimated to be significantly below the cost of TTS. However, it is important to consider other factors in addition to cost prior to drawing any inferences concerning the optimal OJT/TTS mix. The effect of these factors is discussed at length in this report.

PREFACE

This report is the first of two reports describing the results of a contract study entitled "Development, Evaluation, and Application of Methodologies for Determining the Cost of Air Force On-the-Job Training," Contract No. F41609-72-C-0048, conducted by Cooper and Company, Stamford, Connecticut. Mr. Bernard Samers, Cooper and Company, was the principal investigator and wrote this report. Mr. John N. Taylor, AFHRL/MDS, made a major contribution to the revision of the report. Appendix 7, "Selection of an Optimal OJT/TTS Mix," was written by Captain Alan D. Dunham. The cooperation of Mr. C. L. Niblock, Mrs. H. M. Scott, and Mr. C. O. Yelverton, Cost and Economics Analysis Division, Headquarters ATC; and Mrs. Barbara Horner, RAND, is gratefully acknowledged. Dr. Don Meyer's, ATC/XPT, sponsorship and enthusiastic interest in this research is sincerely appreciated.

The work was conducted under Project 2077, Personnel and Manpower Management Systems Development, Task 207703, Computer-Based Models of the Air Force Personnel Subsystem. The research is a partial response to RPR 73-02, Optimal Mix of On-the-Job Training and Technical School.

Captain Alan D. Dunham served as Contract Monitor for the Laboratory. After his reassignment, Major Fred Nordhauser assumed this function.

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THE DEVELOPMENT OF A METHODOLOGY FOR ESTIMATING THE COST OF AIR FORCE ON-THE-JOB TRAINING

I INTRODUCTION

In FY 1973, the Air Force trained some 80,000 non-prior service airmen. At the completion of training, these 1-level (helper) airmen attained the 3-level (semi-skilled) status. The majority of these airmen were trained in Air Training Command (ATC) resident technical training schools (TTS); however, the predominant method of training within the Air Force is on-the-job training (OJT). Upgrade training (UGT) to the 5-level and the 7-level is almost exclusively via formal OJT. The Cost and Economic Analysis Division, DCS/Comptroller, HQ USAF has developed and maintains a Cost Factors Summary which contains current average cost per graduate information for each resident technical training course in ATC. No comparable or similar information is available for on-the-job training courses.

Cost per trainee information for OJT would be useful for policy decisions affecting the planning and programming of airman training, utilization and retention. More specifically, OJT cost information could be used in the selection of an optimal mix for OJT/TTS training, life cycle costing of weapon systems, the selection of Air Force Specialties for Variable Reenlistment Bonus and Proficiency Pay, and the evaluation of the dollar impact of changes to the OJT course curriculum.

In an earlier study (Dunham, 1972), a general equation or model of cost elements for computing OJT costs was developed to be comparable with Air Force resident TTS costs for Category B Air Force Specialty Codes (AFSC).[1]

The Dunham equation for OJT cost is

$$Y = X_1 + X_2 + X_3 + X_4 + X_5 + X_6$$

where: Y = OJT cost per trainee

X_1 = Cost of trainee time spent in training

X_2 = Cost of supervisor time devoted to training

---

[1] Category B specialty trainees may upgrade from the 1-level to the 3-level either by attending TTS or completing OJT. Category A specialty trainees may upgrade via TTS only; while Category C specialty trainees may upgrade via OJT only.

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X_3 ≡ Remedial training cost

X_4 ≡ Records management cost

X_5 ≡ Cost of delayed entry into training

X_6 ≡ Equipment and material costs

For purposes of on-the-job training and resident technical school training cost comparisons, the following cost equation to adjust resident training costs is used.

$$Z = W_1 + W_2 + W_3$$

where Z ≡ Adjusted resident technical training cost

W_1 ≡ Resident technical training cost

W_2 ≡ TTS equivalency cost

W_3 ≡ TTS delay cost

TTS equivalency cost (W_2) adjusts resident training cost (W_1) for the cost of training the 3-level TTS graduate (trainee cost only) to a level of proficiency equivalent to the OJT-trained 3-level. W_3, the TTS delay cost adjusts W_1 for the cost associated with the TTS graduate's delayed entry time into the work force due to such activities as personnel processing and familiarization with local procedures. How W_2 and W_3 are estimated is discussed in more detail later in this report.

The purposes of the present investigation were (a) to develop alternative methodologies for computing estimates of the elements of cost X_1, X_2, X_3, X_4, X_5, and X_6, and adjustments W_2, and W_3 using AFSC 702X0—Administrative Specialty as the experimental case and (b) to apply the preferred methodology to five additional AFSC's. This report will deal only with the development of the methodologies. The application of the "best" methodology to other AFSC's will be presented in a second report, entitled "The Evaluation and Application of a Methodology for Estimating the Cost of Air Force On-the-Job Training."

As alluded to above, Dunham published the results of a study, (Dunham, 1972) designed to estimate the cost of OJT. He investigated the Communication Center Operations Specialty, Air Force Specialty Code (AFSC) 291X0, in that study with the following results: The study provided empirical evidence which strongly supported two hypotheses, namely, that it was possible to obtain "realistic and useful" estimates of OJT costs using survey research techniques and second that there may be large differences between OJT and TTS costs, indicating that it would be worthwhile to continue collecting OJT cost data for other specialties. (Appendix 7 discusses the criteria to be considered in addition to cost

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in determining an optimal OJT/TTS mix).

In his study, Dunham used a mail survey technique to obtain information for estimating the cost elements and adjustment factors. His technique required respondents to make their best judgments about aggregate past experience (e.g., how long does it usually take, in your experience, to complete training to the 3-level for an Administrative Specialist?). This technique asked the respondent to recall experiences that may have occurred months and even years earlier and then to "integrate" them into an average estimate. The results were promising although the variances of the estimates were quite high.

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II DESCRIPTION OF STUDY

A. Identification of Survey Methodologies

To attempt to improve on the methodology used in the Dunham study, two primary alternative approaches were considered. The first, which might be called a Work Sampling Approach, asked the respondent to answer questions about the training he did last week for specific individuals. Note that this still called for some recall (over a much shorter time horizon), but did not require any "integration" of experience.

The second alternative might be called a Self-Recording Approach. The respondent was asked to record his actual training experiences for a week, which largely eliminates the problem of recall.

In addition to these alternatives, two modifications of the original Dunham methodology were also used. The first of these was not methodologically different in the strictest sense. Rather than asking for aggregate experience on how long training might take and how much time might be spent at it, the respondent was asked to describe the trend in the effort over time. In addition to providing an additional piece of information (the differential effort in training over time), the survey provided alternative estimates of the duration and intensity of training.

The second was a major modification of the original Dunham technique. It requires asking the respondent to refer to his own training records (AF Form 623 - Consolidated Training Record) for data on the duration of training and to copy that data out of his records.

While in the original formulation of the study it was assumed that the three methodologies would be kept distinct with three separate questionnaires for each, it soon became apparent that it was more appropriate to combine the methodologies in one survey instrument. This will be discussed in more detail in the subsection "Development and Administration of the Survey Instrument."

In summary, three primary methodologies were explored: (1) Aggregate Experience Approach - asking respondents about their training experience in general; (2) Work Sampling Approach - asking respondents about their training activity last week, and (3) Self-Recording Approach - asking respondents to record their training activity for a week. In addition, respondents were asked to make their best estimates from their general experience about trends in training effort, and to use information contained in official Air Force training records.

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B. Identification of Air Force Specialty

The Air Force Specialty Code studied in this investigation was the Category B AFSC 702X0; Administrative Specialist training from the 1-level (helper) to the 3-level (semi-skilled). The Administrative Specialist at the 3-level is what might typically be called a "clerk-typist." His specific duties will vary considerably with the type of organization and office he is assigned to. "There is probably no other career field with so many possible combinations of duties as administration."[1]

Some of the duties he might be asked to perform are the following:

"a. Type and control correspondence, messages, publications, forms, orders, and inventories.

b. Store microfilmed documents.

c. Dispose of microfilmed documents.

d. Maintain master publication libraries.

e. Prepare and process requisitions for publications and forms.

f. Store and distribute standard, specialized, and recurring publications, technical orders, and forms.

g. Perform mobile distribution system functions.

h. Operate unit mailrooms.

i. Operate postal directory service.

j. Receive visitors, give information, answer phones, and other routine office tasks."[2]

C. Development And Administration Of The Survey Instrument

It was discovered early in the investigation that the number of airmen sent to OJT as a Direct Duty Assignment (DDA) was considerably less than might be expected for the size of the AFSC. At that point there was some concern about obtaining an adequate sample size for each

[1] Apprentice Administration Specialist, Career Development Course 70230, 1971.

[2] Ibid

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of the methodologies. Due to this problem and because there is some advantage from the point of view of direct comparison in having each respondent complete all three methodologies, a combined questionnaire was adopted. In other words, each questionnaire had 3 parts, each corresponding to an alternative methodology and each phrased differently. One disadvantage to this approach is that the questionnaire becomes lengthy and there may be some tendency to do only a perfunctory job on the last part. In an effort to reduce this effect, most of the straightforward informational questions were asked only once. Certain questions were repeated as a check on reliability, but these were always asked in an alternate framework corresponding to the new methodology. The three distinct parts of the questionnaire were preserved, and several new questions were included in the first part which otherwise was primarily the original Dunham methodology adapted to AFSC 702X0.

Initial interviews were held at three Air Force Bases in the San Antonio area: Lackland, Brooks and Kelly. A number of modifications were made to the phrasing and format of the questionnaire as a result of information gained at these interviews. Primarily, the direction was toward simplification and the reduction of ambiguities. Several trial iterations were made until the questionnaire shown in APPENDIX 5 was developed.

Based on information obtained during the initial interviews, it was decided to mail the questionnaires to Central Base Personnel Offices (CBPOs) and to have Base OJT Monitors distribute them to supervisors of OJT trainees. Since the survey was exploratory and of relatively small size, the sampling procedure was designed to survey a wide range of bases in different commands. Information on the number of DDAs in AFSC 702X0 training to the 3-level by base and major air command was obtained from the Personnel Processing Group (Lackland AFB) computer tape files. APPENDIX 1, Survey Mailing by Base and Command, indicates the bases selected, the responsible commands, the number of DDAs at the base, number of surveys sent and the tabulation of the surveys returned. Follow-up procedures were used in an effort to increase the number and percent of returns.

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III RESULTS

A. Survey Response

295 questionnaires were sent to the field. 207 were returned (see APPENDIX 1); 199 were usable. The 199 usable surveys provided information on 270 trainees, but in some cases the responses to specific questions were either missing or ambiguous. A summary of responses to the survey questions is presented in APPENDIX 2. The survey instrument is shown in APPENDIX 5.

All responses were manually edited and reviewed before they were coded and keypunched for data processing. This edit and review led to a number of detailed comments and recommendations for question and survey improvements. These comments and recommendations are provided in APPENDIX 3.

There are several more general comments which merit discussion at this point. First, it was suspected at the outset that the instrument was too long, and this was confirmed by a general falling off of question responses toward the end of the questionnaire. (This could also have been correlated to special difficulties associated with the methodologies utilized in the latter parts of the questionnaire.)

Second, initial information on name, base, etc., was requested using a free format (i.e., fill in lines rather than enter in boxes). Much more uniformity could have been obtained from a more structured format.

Third, in an effort to reduce data processing volume, the number of spaces allowed for an answer to several of the survey questions was kept to a single digit on the assumption this was sufficient for the answer. In several cases it was not. These items are discussed individually in APPENDIX 3.

Finally, it is clear that despite several pre-tests and refinements, some questions were ambiguous, reinforcing the need for more explanation in the questions and more careful instructions in future studies.

B. Comparison of Methodologies

As discussed earlier in this report, three alternative methodologies were evaluated, viz., the Aggregate Experience Approach, where each respondent was asked about his training experience, in

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general; the Work Sampling Approach, where each respondent was asked about his training activity last week; and the Self-Recording Approach, where each respondent was asked to record his training activity for a week. For each methodology, a set of cost equations or models were developed to provide estimates of the cost elements. Questions 1 through 17 in APPENDIX 5, Survey Instrument, relate to the Aggregate Experience Approach; questions 18 through 28 relate to the Work Sampling Approach; and questions 29 through 33 relate to the Self-Recording Approach. Since some of the questions were asked in a slightly different way under two or sometimes three methodologies, clearly, one or two of them may be eliminated in future studies. Also, some questions were asked as an exploratory probe to confirm or reject some related hypotheses. These questions, as well, may be eliminated in future studies.

Estimates of cost elements in terms of means and standard deviations by methodological approach are provided in Table 1, Cost Estimating Relationships (Models). The means and standard deviations were computed using the cost models presented in APPENDIX 4. There were several cost elements that were estimated in more than one way within two given methodologies (the more important cost elements) and several which were estimated only once for all methodologies (the least important cost elements).

There are no simple criteria for evaluating the different methodologies. The "Cost of OJT" is not an observable. It is a concept, and therefore a standard of comparison needs to be defined. Cost per observation, variance, efficiency, per cent responses, number of errors, are all possible explicit criteria. In the final analysis, a subjective judgment and the coefficient of variation (i.e., the ratio of the standard deviation to the mean) were used to assess the validity and bias of the responses to the specific questions. A brief discusssion of each of the cost models used in the development of Table 1 is presented in APPENDIX 6. The discussion in APPENDIX 6 indicates the underlying rationale for the final selection of the models for estimating the cost elements. Table 2 presents the final model selection and an estimate of each of the cost elements and the percent of the total OJT cost.

Tables 1, 2 and APPENDIX 2 display the basic numerical results of the study. In terms of numerical results the following are the most significant highlights and conclusions for the AFSC 702X0, Administrative Specialty analysis.

- It takes about 18 weeks on the average to complete the OJT training.
- A trainee spends an average of ten hours per week training (and about 25 in productive work).

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TABLE 1: COST ESTIMATING RELATIONSHIPS (MODELS)[1]

	MODEL	MEAN $	STD DEV $	N
Aggregate Experience Approach				
1	Trainee Time	610.24	844.53	189
2	Trainee Time	994.61	646.58	56
3	Trainee Time	700.14	528.97	165
4	Instructor Time	262.38	407.28	136
5	Records Mgt Time	103.27	210.26	128
6	Delayed Entry Time	196.05	166.17	197
7	Remedial Training Time	40.03	53.62	72
8	TTS Equiv Time	80.10	80.60	47
9	TTS Delay	201.28	166.77	167
Work Sampling Approach				
11	Time to Proficiency (Non-Cost)	24.41	24.26	169
12	Trainee Time	744.60	1397.56	167
13	Instructor Time	965.58	1801.37	157
14	Delayed Entry Time	208.95	226.60	165
15	Record Mgt Time	137.70	215.05	51
16	TTS Delay Time	160.01	183.32	74
17	TTS Equiv Time	201.16	744.68	62
Self-Recording Approach				
21	Trainee Time	409.78	415.08	163
22	Productive Time	821.46	599.82	163
23	Instructor Time	591.35	576.77	55
24	Trainee Time	570.18	449.70	55

[1] In addition to these models two other estimates of cost elements were used. One is the cost of Tech School which is discussed in subsection C. The other is the cost of Equipment and Materials. The variable cost of producing and administering CDC Manuals, the only significant equipment and material item, was estimated to be $10.18 by Headquarters Air University/ECI.

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TABLE 2: SUMMARY OF OJT COST ELEMENTS

Element	Model	Cost	%
Trainee Time (X_1)	24	570.18	36.9
Instructor Time (X_2)	23	591.35	38.3
Delayed Entry Time (X_5)	6	196.05	12.7
Records Management Time (X_4)	15	137.70	8.9
Remedial Training Time (X_3)	7	40.03	2.6
Equipment & Material[1] (X_6)	-	10.18	.6
		1545.49	100.0

TTS Elements		
TTS Equivalency (W_2)	8	80.10
TTS Delay (W_3)	9	201.28
Total		281.38

[1]See Footnote to Table 1.

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- The amount of trainee time spent in training is about 25 hours per week initially, but trails off over the training period.

- An instructor spends an average of nine hours per trainee per week.

- Remedial training and record keeping have relatively small costs.

- On the average, the TTS graduate has only about 1/3 the proficiency of an OJT trained airman when he starts, but it only takes him about 4 1/2 weeks to make up the difference.

- The cost per trainee of upgrading by OJT to AFSC 70230 is about $1500.

In terms of methodology the following are the most significant highlights and conclusions:

- Asking respondent to make estimates of time and duration based on an integration of their experience yields high variance, biased estimates.

- A journal recording procedure asking specific questions about the time spent during a given week, can yield reasonably good information about "time spent per week" providing the sample is large enough.

- Information on the duration of training can most properly be derived from historical records, either the AF Form 623 or the Uniform Airman Record.

- A much smaller, easier to complete instrument can be developed which is AFSC independent.

- A combination of methodological approaches will probably yield the best Phase II questionnaire.

- Dunham's technique (the original methodology) asking for average historical experience, is useful for certain of the smaller cost elements. Major cost elements can be developed with greater accuracy from journal recording and already existing data.

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C. TTS Costs

In the Dunham study, TTS costs were derived from estimates developed by RAND Corporation (Allison, 1971) based on a generalized costing methodology which included total recurring costs (both fixed and variable.)[1] RAND estimates were also obtained in May 1973 for the 70230 specialty. These estimates yield a cost of $2480 per trainee on an average cost basis. Eliminating the fixed costs to make the costs more comparable to the OJT cost estimates, the cost per trainee would be $2000. In addition to the $2000, it is appropriate to add the results of Models 8 and 9, TTS Equivalency Time and TTS Delayed Entry into Training (see Table 2). The net effect of these two adjustments would be to add $281, for a total of $2281 per trainee.

D. Quality of OJT and TTS Graduates

In addition to comparing the costs of training, the quality of OJT and TTS graduates was also compared in terms of performance as perceived by supervisors. Responses to questions 11.3 and 11.4 (i.e., 11c and 11d) indicate that 54% of the supervisors perceived a difference between the performance of OJT and TTS graduates after achieving the 5-level. Of the 87 supervisors responding to question 11d, 51 (or 59%) considered TTS graduates superior; while 36 (or 41%) considered OJT graduates superior. However, 75 supervisors (question 11c) indicated neither was superior. Thus there is insufficient evidence to support the hypothesis that TTS graduates are superior in terms of performance to OJT graduates as perceived by supervisors. This conclusion is in accord with Dunham's study of the Communications Center Operations Specialty. In that study, he analyzed the Specialty Knowledge Test (SKT) scores for TTS and OJT trainees and found essentially no differences for the two types of trainees. In another AFHRL investigation (Lecznar, 1972), the performance of OJT and TTS trainees was compared in terms of six criteria: a job difficulty index, average task difficulty, number of tasks performed, job interest, self-report of utilization of talent and training, and overall performance ratings. Again, no advantage of TTS over

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OJT training was found. Perhaps, the most thorough investigation of this topic was reported by Dunham at the 1973 Military Testing Association Meetings (Dunham, 1973). In that study, OJT and TTS graduates were again compared in terms of SKT scores, however, the trainee's race, AQE scores and SKT version were held constant. Using an analysis of covariance, it was again concluded that for six Category B AFSCs (including AFSC 70230) OJT and TTS graduates were of equal quality.

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IV DISCUSSION OF RESULTS

A. Advantages And Disadvantages Of Each Methodology

Each of the three survey approaches or methodologies used has a number of advantages and disadvantages relative to each other as well as relative to other alternative methodologies. A time and motion analysis such as might be conducted under the USAF Management Engineering Program (see AF Manual 25-5) was not used because of the exploratory nature of OJT costing studies and the requirement to commit a larger amount of dollar and manpower resources. An interview technique was evaluated by Dunham in a previous study and the advantages of the interview approach versus the survey approach were discussed in that report (Dunham, 1972).

The Aggregate Experience Approach (based on Supervisor's total OJT experience) has the relative advantages of (1) a larger sample availability at any one time and (2) completion at one sitting. The disadvantages include (1) a larger empirical variation in responses and (2) Air Force Specialty dependence which requires different survey forms for each specialty, multiple computer program formats for analysis and maintenance of OJT cost data, and makes the aggregation and comparison of OJT cost across specialties more difficult.

The advantages of the Work Sampling Approach are that (1) the survey instrument can be completed in one sitting, (2) it is specialty independent, (3) the recall required is for more recent experience (1 week) and (4) the response variance is less than for the Aggregate Experience Approach. The disadvantage is that a larger sample size is required in order to ensure the presence of an OJT trainee during the previous week.

Advantages associated with the Self-Recording Approach are (1) it is specialty independent, (2) the recall involved is limited to one day and (3) it has generally reduced response variance as compared to other survey approaches. The disadvantages of the Self-Recording Approach are (1) it requires a larger initial sample, since a currently enrolled OJT trainee is required and (2) the turn around time is longer, and this may result in a smaller usable sample due to the increased time the questionnaire is in the field.

Thus, the selection of a survey approach involves a number of trade-offs. The study supported the possibility of obtaining reasonable estimates of time spent by trainees and instructors through the Self-Reporting Approach and this is perhaps the superior of the three methodologies, depending the least on recall. The one advantage to asking for recall rather than future recording is timeliness. Recall can be

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accomplished immediately as the questionnaire is completed. "Journal Recording" requires time and, therefore, jeopardizes return of the questionnaire. Given the high level of responses, this did not seem to be a problem.

Though not really a part of any of the methodologies, previously recorded data is often the best and cheapest source of information, particularly if it has been authenticated for other purposes. The use of recorded data on Date of Entry into Training and Date of Award of AFSC was included in the first section of the survey as an extension of the existing methodology. This is an important way of developing the data; although it may be easier to get this information from the Uniform Airman Record File, rather than asking the supervisors to copy it out of the AF Form 623.

The original Dunham methodology is desirable for sampling relatively infrequent phenomena, since any "current" sampling scheme using journal recording would have to involve very large samples. On the other hand, for sampling ongoing major work activities, the journal recording scheme seems a desirable alternative methodology.

In summary, both the earlier methodology and "journal recording" have potential for eliciting cost data. The applicability of a specific methodology depends on the specific data item in question.

B. Relationship of OJT Costs to TTS Costs

We have shown that for AFSC 702X0, the Administrative Specialty, OJT costs were $1545 and TTS costs were $2281. This is a substantial difference which is consistent with results obtained by Dunham (1972).

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V CONCLUSIONS

A. Significance Of Results

The most significant result of the present study (Phase I) is that it advances the mail survey technique as an effective method for developing estimates of OJT costs. A number of modifications to the original Dunham approach were developed and applied in Phase I. Based on the results obtained in Phase I, it should now be possible to specify a survey methodology and a smaller, more precise, AFSC independent questionnaire with reasonable promise of providing useful OJT cost estimates for additional AFSC's (Phase II).

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APPENDICES

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APPENDIX 1: SURVEY MAILING BY BASE AND COMMAND

BASE NAME	COMMAND	#DDA'S	#SURVEYS SENT	#SURVEYS RETURNED
Bolling	HDQ	1	1	0
Edwards	AFSC	5	5	4
Chanute	ATC	3	3	2
Hancock	ADC	1	1	1
Hill	AFLC	2	2	0
Wright Patterson	AFLC	2	2	2
Mather	ATC	9	9	6
Minot	SAC	7	7	0
Grand Forks	SAC/ADC	9	9	8
Patrick	AFSC	6	6	2
Bergstrom	TAC	11	10	8
Forbes	TAC/MAC	13	10	6
Griffis	SAC/AFSC	12	10	7
Kirtland	AFSC	19	10	10
Langley	TAC/AFSC	16	10	4
Norton	MAC	12	10	9
Randolph	ATC	12	10	6
Lowry	ATC	12	10	9
Luke	TAC/ADC	17	10	8
McChord	MAC/ADC	15	10	10
Barksdale	SAC	49	15	15
Carswell	SAC	32	15	2
Castle	SAC	25	15	15
Charleston	MAC	26	15	13
Dover	MAC/ADC	24	15	14
Eglin	AFSC/TAC	27	15	1
Ellsworth	SAC	32	15	9
Lackland	ATC	25	15	14
Travis	MAC/SAC	41	15	9
Maxwell	AU	26	15	13
	TOTAL	491	295	207

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APPENDIX 2: SUMMARY OF RESPONSES TO QUESTIONS[1]

		MEAN	STANDARD[2] DEVIATION	NUMBER OF[3] RESPONSES
1.	Persons In Section	7.27	7.46	196
2.	Days Delay In Start - 3	8.60	7.29	197
3.	Days Delay In Start - 5	8.44	7.00	167
4.	Weeks To 3 Level Proficiency	13.30	7.00	178
5.	Weeks - Proficiency To Award	3.31	2.61	158
6.1	Number of 3-Level Trainees	1.34	0.84	198
6.2	Number of 5-Level Trainees	1.06	1.45	197
7.	More Trainees Possible	1.11	1.23	197
8.	More Trainees Without 5's	0.77	1.02	184
9.1	Operate With Less Personnel[4]	0.29	0.03	197
9.2	Number Fewer	1.14	1.16	79
10.	Are 3's Productive[4]	0.82	0.03	191
11.1	Pct of 3 Skill On Arrival (Grads)	31.79	23.76	172
11.2	Additional Weeks To 3 Level	4.48	2.35	166
11.3	Difference In Training[4]	0.54	0.04	164
11.4	OJT Superior[4]	0.41	0.05	87
12.1	Pct Failing (AKT)	25.64	24.75	108
12.2	Weeks Remedial Training	3.60	1.81	105
12.3	Trainee Remedial Hours	9.07	7.20	107
12.4	Instructor Remedial Hours	5.28	3.41	106
13.	Record Keeping Hours	1.94	3.42	189
14.	Number of E3 Instructors	1.39	0.85	18
	Number of E4 Instructors	1.28	0.64	60
	Number of E5 Instructors	1.20	0.57	89
	Number of E6 Instructors	1.09	0.51	35
	Number of E7 Instructors	1.00	0.0	12
	Average Grade Of Instructors	4.82	0.79	141

[1]Note that question parts a, b, c, etc., are coded .1, .2, .3, etc.

[2]This is "S," an unbiased estimate of the Universe Standard Deviation, derived from the sample. A confidence limit on the sample mean would be derived from the standard error of the mean, $S/\sqrt{n}$.

[3]This is the number of valid responses, (e.g., blanks or unreadable responses have not been counted).

[4]Questions 9.1, 10., 11.3 and 11.4 have dichotomous answers with the results expressed as proportions. Thus the mean is a fraction and the standard deviation is $\sqrt{pq/n}$ which is the standard error of the binomial distribution. The response to Question 10. should be interpreted "82% responded yes."

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APPENDIX 2 (Cont.)

15.	Skill	EXPERIENCE			WEEKS TO PROFICIENCY		
		Pct	Std Dev	N	Mean	Std Dev	N
15.1	Career	0.99	0.01	178	2.86	4.21	170
15.2	Security	0.97	0.02	131	2.05	2.41	129
15.3	Supervision	0.97	0.02	76	4.80	7.44	71
15.4	Equipment	0.99	0.01	186	3.78	3.92	180
15.5	Publications	0.99	0.01	156	4.51	4.07	150
15.6	Forms	0.98	0.01	122	3.64	3.56	117
15.7	Communications	0.98	0.01	135	4.99	5.08	130
15.8	Documentation	0.98	0.01	124	5.02	5.03	118
15.9	Library	0.71	0.08	35	2.70	3.53	30
15.0	Postal	0.76	0.06	49	3.10	3.72	42

		INSTRUCTOR HRS/WEEK			TRAINEES/INSTRUCTOR		
		Mean	Std Dev	N	Mean	Std Dev	N
15.1	Career	2.94	3.98	174	1.67	1.00	177
15.2	Security	1.78	1.38	129	1.73	1.13	132
15.3	Supervision	3.22	5.05	73	1.68	1.01	78
15.4	Equipment	3.31	4.48	182	1.69	1.09	182
15.5	Publications	3.59	5.70	151	1.66	0.96	154
15.6	Forms	2.65	4.23	117	1.64	1.03	121
15.7	Communications	3.27	4.44	132	1.79	1.18	135
15.8	Documentation	3.04	4.32	121	1.81	1.17	124
15.9	Library	1.16	0.73	31	1.53	1.18	36
15.0	Postal	2.07	2.74	44	1.73	1.40	51

		TRAINEE HRS READING			TRAINEE HRS OJT		
		Mean	Std Dev	N	Mean	Std Dev	N
15.1	Career	2.48	2.62	177	5.30	8.11	174
15.2	Security	1.83	2.16	131	2.06	2.12	127
15.3	Supervision	2.87	4.86	75	4.03	5.46	72
15.4	Equipment	2.09	2.25	180	7.05	8.47	182
15.5	Publications	2.99	4.53	156	4.84	6.25	153
15.6	Forms	2.07	2.09	120	3.36	4.83	116
15.7	Communications	2.64	2.55	135	5.64	7.23	132
15.8	Documentation	2.52	2.55	124	4.40	6.34	121
15.9	Library	1.71	1.41	35	2.31	4.61	29
15.0	Postal	2.04	1.46	48	3.00	4.37	43

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APPENDIX 2 (Cont.)

16.

Week	TRAINEE HRS PRODUCTIVE Mean	Std Dev	N	TRAINEE HRS INSTRUCTION Mean	Std Dev	N
1	11.87	8.88	162	27.54	9.45	162
4	17.92	8.33	160	21.95	8.44	160
8	23.44	8.03	150	16.68	7.96	149
12	27.25	7.74	136	12.89	7.60	135
16	30.78	7.41	116	9.43	7.37	115
20	33.21	8.67	105	6.95	8.72	104

17.

	OJT Mean	Std Dev	N	TECH SCHOOL Mean	Std Dev	N
AQE MECH	44.34	23.70	301	37.97	20.19	72
AQE ADMIN	63.62	15.54	300	58.96	14.75	72
AQE GEN	59.63	18.95	300	52.22	17.22	72
AQE ELEC	54.07	19.67	300	48.88	17.40	72
ED LEVEL	12.33	1.10	318	12.18	0.91	78
AFSC-Entry	160.03	74.89	105	86.69	69.45	36

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APPENDIX 2 (Cont.)

QUESTION		MEAN	STD DEV	N
18.	Week Of Training	10.88	8.27	176
19.	Pct Training Completed	56.21	28.42	176
20.	Pct of 3 Skill On Arrival	10.93	14.30	176
21.	Days Delay In Start - 3	9.16	9.94	165
22.	Trainee Hours	9.07	7.82	180
23.	Instructor Hours	10.88	10.71	178
	Instructor Hours/Trainee	7.91	7.48	171
24.	Record Keeping Hours	1.88	2.86	178
	Record Keeping Hours/Trainee	1.36	1.60	171
25.	Number of E3 Instructors	1.17	0.58	23
	Number of E4 Instructors	1.12	0.39	50
	Number of E5 Instructors	1.11	0.46	91
	Number of E6 Instructors	1.10	0.63	48
	Number of E7 Instructors	1.03	0.33	29
	Average Grade Of Instructor	5.03	0.92	129
26.	Days Delay In Start - 5	6.71	7.69	74
27.	Pct Of 3 Skill On Arrival - 5	29.57	22.81	82
28.	Additional Wks To 3 Level - 5	5.05	4.88	76
30.	Number Of Trainees	1.30	0.71	186
31.	Trainee Hrs Instruction	10.61	6.72	173
32.	Trainee Hrs Productive	24.73	17.85	172
33.	Instructor Hrs E3	9.15	7.17	20
	Instructor Hrs E4	10.90	9.70	41
	Instructor Hrs E5	8.00	5.27	81
	Instructor Hrs E6	8.05	6.57	41
	Instructor Hrs E7	6.78	5.16	23
	Average Instructor Hrs/Trainee	8.80	6.69	158
	Average Grade Of Instructor	5.05	0.98	159

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APPENDIX 3: DETAILED COMMENTS AND RECOMMENDATIONS ON QUESTIONS AND RESULTS

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APPENDIX 3: DETAILED COMMENTS AND RECOMMENDATIONS ON QUESTIONS AND RESULTS

1.	PERSONS IN SECTION		
2.	DAYS DELAY IN START - 3	-	These answers are slightly more efficient than 21 & 26
3.	DAYS DELAY IN START - 5		
4.	WEEKS TO 3 LEVEL PROF	-	Serious under-estimate--questions 16, 17.7, 18 & 19 suggest 20 weeks, not 13 weeks, is a better estimate--delete
5.	WEEKS - PROF TO AWARD	-	Slight truncation in editing because of only one space in questionnaire; convert to two on next survey
6.1	NO. 3-LEVEL TRAINEES	-	Checks well with 23 & 30
6.2	NO. 5-LEVEL TRAINEES	-	Only useful for general information--delete
7.	MORE TRAINEES POSSIBLE	-	Indicate some slack in instructor time--questions are awkward
8.	MORE TRAINEES WITHOUT 5'S		
9.1	OPERATE WITH LESS PERSNL - PCT	-	Indicates trainees are contributing to productivity
9.2	NO FEWER		
10.	ARE 3'S PRODUCTIVE	-	Corroborates questions 16, 22, 31 & 32--question 7 through 10 are not used in cost models, but are interesting for general information purposes--they should be revised and combined
11.1	PCT OF 3 SKILL ON ARVL - TECH SCHOOL GRADS	-	Very similar to, but more response than 27--perhaps because at end of survey, perhaps because of "last week"

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APPENDIX 3 (Cont.)

11.2	ADDITIONAL WKS TO 3 LEVEL	-	Significantly smaller with smaller variance than 28, although answer was slightly truncated in editing because of 1 box--convert to two on next survey
11.3	DIFFERENCE IN TRNG - PCT	-	Yields little definitive information, other than quality of training may be random--delete--responses to question 11 compare weli with Dunham study
11.4	OJT SUPERIOR - PCT		
12.1	PCT FAILING ECT	-	Even with high estimate in 12.1 remedial training model shows dollar amount to be very small--12.2 should have 3 spaces
12.2	WKS REMEDIAL TRAINING		
12.3	TRAINEE REMEDIAL HRS		
12.4	INSTRUCTOR REMEDIAL HRS		
13.	RECORD KEEPING HOURS	-	Question 24 has smaller variance--both extremely small--subject to considerable round off errors in editing, because a single space was provided--also so small that validity of estimates are subject to doubt--delete
14.	AVERAGE GRADE OF INST	-	Poorly phrased (as connected with 8)--33 gives the most response and weights more accurately--delete
15.	SKILLS	-	High variance to mean ratio--probably too many categories and no total time reference--information on skills is interesting but question is AFSC-dependent, which is undesirable in the long run

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APPENDIX 3 (Cont.)

16.	TRAINEE HRS PRODUCTION TRAINEE HRS INSTRUCTION	-	Important and informative question--see comments on question 4--shows trend clearly although absolute values probably overstated--see 22, 30 & 31--if used again revise instruction to ask for an entry in every week shown, so that for later weeks an aswer like 40, production, 0, instruction is given more weight
17.	TRAINEE AQE, ED LEVEL AND TRAINING HISTORY	-	Correlations show nothing, although a slight tendency to send higher AQE Admin to OJT agrees here with Dunham work--"AFSC-Entry to Award" yields useful data--but response is not high, and it may be subject to "copying" errors--development of AFSC entry to award from Uniform Airman Record would be very useful
18.	WEEK OF TRAINING	-	This is probably the most potent way of determining length of training (the mean is the mid-range of a uniform distribution of length in training)--supervisor is asked to recall a number he can figure out--it is not an "average experience guess" but he usually doesn't have to look it up and can probably give it quite accurately
19.	PCT OF TRAINING COMPLETED	-	While this is a guess, the mean suggests its not too bad on the average and corroborates 18--question would have been better if relationship to 20 was spelled out
20.	PCT OF 3-SKILL ON ARRIVAL	-	Helps to confirm notions of productivity in 16 and 32 by demonstrating capability--
21.	DAYS DELAY IN START - 3	-	See comments on 2--delete

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22.	TRAINEE HOURS	-	Very similar, slightly less efficient than 31--delete
23.	INSTRUCTOR HOURS	-	Compares well with 33 but 33 also yields grade--delete
24.	RECORD KEEPING HOURS	-	See comments on 13--delete
25.	AVERAGE GRADE OF INSTRUCTORS	-	See comments on 14--33 is probably best question--delete

Note: Questions 18 through 25 provide very little information by having 3 columns, (3 trainees). They confuse respondent and make processing difficult. Relatively few surveys provided information on second or third trainee. A more appropriate way to handle the problem might be to ask the respondent to provide information on the trainee who is most nearly average, when he has more than one, or to simply sum over all trainees as was done in Part C.

26.	DAYS DELAY IN START - 5	-	26 through 28 should not be asked of instructors selected on the basis of training 3's--asking about last week leads to lower response and higher variance--should be asked in general as in questions 3, 11.1 and 11.2--delete
27.	PCT OF 3-SKILL ON ARRIVAL 5		
28.	ADDITIONAL WKS TO 3-LEVEL 5		
29.	DATE STARTED RECORD KEEPING	-	Not necessary--delete
30.	NUMBER OF TRAINEES	-	See 6.1--delete
31.	TRAINEE HRS INSTRUCTIONS	-	See 22 "Best" Method of Estimating Time
32.	TRAINEE HRS PRODUCTIVE	-	Important as a contrast to 31 (See 16)
33.	AVERAGE GRADE OF INSTRUCTOR	-	See comments on 14, 23, 25

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APPENDIX 4: COST MODELS

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COST MODELS - PART A

TRAINEE TIME 1

Trainee wage/hr $\sum_{i=1}^{n\ \text{skills}}$ weeks for skill i (trainee hrs. for skill i/week)

$$TT1 = WE2 \sum_{i=1}^{n=10} 15.i.2.(15.i.3. + 15.i.4.)$$

TRAINEE TIME 2

Trainee wages/day $\left[\sum_{i=1}^{n\ \text{trainees}} \frac{\text{date of AFSC - date of entry}}{\#\ \text{of trainees}} - \text{wks from profcncy to award (7)}\right] \frac{5}{7} \cdot$

$$\sum_{i=1}^{n\ \text{trainees}} \frac{\text{(non prod hrs)}}{40\ (\#\ \text{of trns})}$$

$$TT2 = WE2(8)\left[\sum_{i=1}^{n\leq 4} (17.i.8. - 17.i.7. \mid 17.i.9 = 1)/n - (7)5.\right]\frac{5}{7} \sum_{i=1}^{n\leq 6} \frac{16.i.2.}{40\ n} \ *$$

TRAINEE TIME 3

Trainee wage/week (time to proficiency in weeks) $\sum_{i=1}^{n\ \text{trainees}} \frac{\text{non productive hrs}}{40\ (\#\ \text{of trainees})}$

$$TT3 = WE2(40)(4.) \sum_{i=1}^{n\leq 6} \frac{16.i.2.}{40\ n}$$

INSTRUCTOR TIME 4

$\sum_{i=1}^{n\ \text{instructors}} \frac{\text{wages for instructor i./hr.}}{n\ \text{instructors}}$ $\sum_{i=1}^{n\ \text{skills}}$ weeks for skill i (inst. hrs for skill i)

(instructors/trainee for skill i)

$$IT4 = \sum_{i=3}^{n\leq 7} 14.i.(WEi.)\left[\sum_{i=3}^{n\leq 7} 14.i.\right]^{-1} \sum_{i=1}^{n=10} 15.i.2.(15.i.5)(15.i.6.)^{-1}$$

*Note: The conditional (17.i.9 = 1) is the code for an OJT trainee.

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RECORDS MANAGEMENT TIME 5

$$\sum_{i=1}^{n \text{ instructors}} \frac{\text{wages for instructor i/hr}}{\text{instructors}} \quad \text{instructor record kpng hrs/wk (wks to proficiency)}$$

$$RM5 = \sum_{i=3}^{n\leq 7} 14.i.(WEi.) \left[\sum_{i=3}^{n\leq 7} 14.i.\right]^{-1} (13.)(4.)$$

DELAYED ENTRY TIME 6

Trainee wages/day (time waiting to begin 3 level training)

$$DE6 = WE2\ (8)(2.)$$

REMEDIAL TRAINING TIME 7

$$\left[\sum_{i=1}^{n \text{ instructors}} \frac{\text{wages for instructor i./hr}}{\text{n instructor}} \text{ (weeks remedial training) (hrs/wk instructor time)} + \text{trainee wage/hr (weeks remedial training) (hrs/wk trnee time)}\right] \cdot \text{(\% failing end of course test)}$$

$$RT7 = \left[\sum_{i=3}^{n\leq 7} 14.i.(WEi.) \left[\sum_{i=3}^{n\leq 7} 14.i.\right]^{-1} (12.b.)(12.d.) + (WE2)(12.b.)(12.c.)\right] \frac{(12.a.)}{100}$$

TECH SCHOOL EQUIVALENCY TIME 8

$$\text{(Weeks to equivalency)} \left[\frac{1 - \text{percent capability}}{2}\right] \left[\frac{\text{trnee time + instructor time}}{\text{wks to proficiency}}\right]$$

$$TSE8 = (11.b.) \left[\frac{1 - (11.a./100)}{2}\right] \left[\frac{TT24 + IT23}{K^*}\right]$$

TECH SCHOOL DELAY 9

(Trainee wage/day) (days delay)

$$TSD9 = WE3(8)(3.)$$

$$^*\text{Where } K = \left[\sum_{i=1}^{n<4} (17.i.8. - 17.i.7.|17.i.9. = 1)/n - (7)5.\right] \frac{1}{7}$$

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COST MODELS PART B

TIME TO PROFICIENCY (NOT COST) 11

$$\sum_{i=1}^{n \text{ trainees}} \frac{\text{week of training (100)}}{(\%\ \text{complete})\ n \text{ trainees}}$$

$$TP11 = \sum_{i=1}^{n \leq 3} \frac{(18.i.)100}{(19.i.)\ n}$$

TRAINEE TIME 12

$$\text{Trainee wage/hr} \sum_{i=1}^{n \text{ trainees}} \frac{\text{trainee hours instruction (time to proficiency)}}{n \text{ trainees}}$$

$$TT12 = WE2 \sum_{i=1}^{n \leq 3} \frac{(22.i.(TP11)}{n}$$

INSTRUCTOR TIME 13

$$\sum_{i=3}^{7 \text{ instructors}} \frac{\text{wages/for instructor } i/\text{hr}}{\text{no. of instructors}} \left[\frac{(\text{instructor hr/week})(\text{time to proficiency})}{n \text{ trainees}}\right]$$

$$IT13 = \sum_{i=3}^{n \leq 7} 25.i.(WEi) \left[\sum_{i=3}^{n \leq 7} 25.i.\right]^{-1} \frac{(23.)(TP11)}{n}$$

DELAYED ENTRY 14

$$\text{Trainee wages per day} \sum_{i=1}^{n \text{ trainees}} \frac{\text{days waiting to begin training}}{n \text{ trainees}}$$

$$DE14 = WE2(8) \sum_{i=1}^{n \leq 3} \frac{(21.i.)}{n}$$

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COST MODELS PART B (Cont.)

RECORDS MANAGEMENT 15

$$\sum_{i=3}^{7 \text{ instructor}} \frac{\text{wages/(hr for instructor i/hr)}}{\text{no. of instructors}} \left[\frac{\text{(record keeping hrs/wk) (time to proficiency)}}{\text{n trainees}} \right]$$

$$RM15 = \sum_{i=3}^{n \leq 7} 25.i.(WEi) \left[\sum_{i=3}^{n \leq 7} 25.i. \right]^{-1} \frac{(24.)\ K}{n}$$

TECH SCHOOL DELAY 16

$$\text{Trainee wage/day} \sum_{i=1}^{\text{n trainees}} \frac{\text{trainee days delay}}{\text{n trainees}}$$

$$TSD16 = WE3(8) \sum_{i=1}^{n \leq 3} \frac{(26.i.)}{n}$$

TECH SCHOOL EQUIVALENCY TIME 17

$$\sum_{i=1}^{\text{n trainees}} \frac{\text{(weeks to equivalency)}}{\text{n trainees}} \left[\frac{\text{(1 - percent capability)}}{2} \right] \left[\frac{\text{trnee time + instructor time}}{\text{weeks to proficiency}} \right]$$

$$TSE17 = \sum_{i=1}^{n \leq 3} \frac{(28.i.)(1 - (27.i./100))}{n\ (2)} \left[\frac{TT12 + TT13}{TP11} \right]$$

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COST MODELS - PART C

TRAINEE TIME 21

$$\text{Trainee wage/hr} \sum_{i=1}^{5\ \text{days}} \frac{\text{trainee hrs/day (weeks to proficiency)}}{\text{number of trainees}}$$

$$TT21 = WE2 \sum_{i=1}^{n=5} \frac{(31.i.)(4.)}{30.}$$

PRODUCTIVE TIME 22

$$\text{Trainee wage/hr} \sum_{i=1}^{5\ \text{days}} \frac{\text{trainee productive hrs/day (weeks to proficiency)}}{\text{number of trainees}}$$

$$PT22 = WE2 \sum_{i=1}^{n=5} \frac{(32.i.)(4.)}{30.}$$

INSTRUCTOR TIME 23

$$\sum_{i=3}^{n\leq 7} \sum_{j=1}^{5\ \text{days}} \frac{(\text{wages for instructor } i/\text{hr})(\text{instructor hrs/day})(\text{weeks to proficiency})}{\text{number of trainees}}$$

$$IT23 = \sum_{i=3}^{n\leq 7} \sum_{j=1}^{5} \frac{(WEi)33.i.j.}{30.} \quad (K)$$

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TRAINEE TIME 24

$$\text{Trainee wage/hr} \sum_{i=1}^{5\ \text{days}} \frac{\text{trainee hrs/day}}{\text{number of trnees}} \cdot$$

$$\left[\sum_{i=1}^{n\ \text{trainees}} \frac{\text{date AFSC - date entry - wks proficiency to award (7)}}{\text{number of trainees}}\right] \frac{1}{7}$$

$$TT24 = WE2 \sum_{i=1}^{n=5} \frac{31.i.}{30.} \left[\sum_{i=1}^{n<4} (17.i.8. - 17.i.7. \mid 17.i.9 = 1)/n - (7)5.\right] \frac{1}{7}$$

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OUTPUT MODELS*

MODEL 31, 32 - AVERAGE GRADE OF INSTRUCTOR

$$\sum_{i=3}^{n \text{ instructors}} \frac{\text{no. of instructors in grade } i}{\text{no. of instructors}} \text{ (grade } i\text{)}$$

X, Y
14,31
25,32

$$M(Y) = \sum_{i=3}^{n<7} X.i.(i.) \left[\sum_{i=3}^{n<7} X.i. \right]^{-1} \qquad X = 14, 25$$

MODEL 33 → 42 - AVERAGE CHARACTERISTIC OF TRAINEE

OJT		TTS	
X,	Y	X,	Y
2,	33	2,	38
3,	34	3,	39
4,	35	4,	40
5,	36	5,	41
6,	37	6,	42

$$\sum_{i=1}^{N \text{ trainees}} \frac{\text{characteristic variable}}{\text{total number of trainees}} \quad \text{For OJT, For Tech School}$$

$$M(Y) = \sum_{i=1}^{N} \frac{17.i.X}{N} \quad | \quad 17.i.9. = 1,0 \quad 2 \leq X \leq 6$$

MODEL 43,44 - AVERAGE TIME BETWEEN ENTRY AND AFSC

$$\sum_{i=1}^{N \text{ trainees}} \frac{\text{date of AFSC - date of entry}}{\text{total number of trainees}} \quad \text{For OJT, For Tech School}$$

OJT	TTS
43	44

$$M(Y) = \sum_{i=1}^{N} \frac{17.i.8. - 17.i.7.}{N} \quad | \quad 17.i.9. = 1,0$$

MODEL 45 → 52 - AVERAGE ACTIVITY OF TRAINEE

X,	Y
18,	45
19,	46
20,	47
21,	48
22,	49
26,	50
27,	51
28,	52

$$\sum_{i=1}^{N \text{ trainees}} \frac{\text{activity}}{\text{number of trainees}}$$

$$M(Y) = \sum_{i=1}^{N<3} \frac{X.i.}{N} \qquad \begin{matrix} 18 < X < 22 \\ 26 \leq X \leq 28 \end{matrix}$$

*The Output Models are used to compute certain intermediate results that were shown in Table 1, e.g., average grade of instructor.

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OUTPUT MODELS (Cont.)

MODEL 53,54 - INSTRUCTOR ACTIVITY/TRAINEE

X, Y
23,53
24,54

$$\frac{\text{instructor activity}}{\text{number of trainees}}$$

$$M(Y) = \frac{X.}{n} \qquad X = 23,24$$

MODEL 55,56 - ACTIVITY PER WEEK

X, Y
31,55
32,56

$$\sum_{i=1}^{5 \text{ days}} \frac{\text{activity/day}}{\text{n trainees}} \qquad X = 31,32$$

$$M(Y) = \sum_{i=1}^{n \leq 5} \frac{X.i.}{30} \qquad X = 31,32$$

MODEL 57 → 61 - ACTIVITY PER WEEK

X, Y
33.3, 57
33.4, 58
33.5, 59
33.6, 60
33.7, 61

$$\sum_{i=1}^{5 \text{ days}} \text{activity/day} \qquad 33.3 \leq X \leq 33.7$$

$$M(Y) = \sum_{i=1}^{n \leq 5} X.i. \qquad 33.3 \leq X \leq 33.7$$

MODEL 62 - INSTRUCTOR HOURS/TRAINEE

$$\sum_{j=3}^{7 \text{ instructors}} \quad \sum_{i=1}^{5 \text{ days}} \frac{\text{instructor hrs/day}}{\text{n trainees}}$$

$$M(62) = \sum_{j=3}^{n \leq 7} \quad \sum_{i=1}^{m \leq 5} \frac{33.j.i.}{30.}$$

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MODEL 63 - AVERAGE GRADE OF INSTRUCTOR

$$\sum_{j=3}^{7\ \text{instructors}} \sum_{i=1}^{5\ \text{days}} \frac{\text{instructor hrs/day (instructor grade)}}{\text{instructor hrs}}$$

$$M(63) = \sum_{j=3}^{n<7} \sum_{i=1}^{m\leq 5} 33.j.i(j) \left[\sum_{j=3}^{n<7} \sum_{i=1}^{m=5} 33.j.i \right]^{-1}$$

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APPENDIX 5: SURVEY INSTRUMENT

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AIR FORCE

HUMAN RESOURCES

LABORATORY

702X0 OJT SURVEY

AFPT 80-702-106

This survey is part of AF Contract #F41609-72-C-0048, for which Personnel Research Division of the AF Human Resources Lab is the contract monitor.

AIR FORCE SYSTEMS COMMAND

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DEPARTMENT OF THE AIR FORCE
AFHRL PERSONNEL RESEARCH DIVISION (AFSC)
LACKLAND AIR FORCE BASE, TEXAS 78236

REPLY TO ATTN OF: PESE (Capt Dunham/4106) 13 OCT 82

SUBJECT: 702X0 OJT Survey

TO: 702X0 Supervisors

1. The purpose of the attached survey is to collect data concerning On-the-Job Training to the 3-level in the Administration specialty. This survey data, along with information from other sources, will be used in decisions concerning OJT and Technical Training School.

2. Answering the survey questions with some thought and effort will aid Air Force decision makers in the management of your AFSC.

3. Permission to conduct this survey was granted by Hq USAF/DPXOS, reference Air Force Personnel Test (AFPT) Number 80-702-106.

FOR THE COMMANDER

RALPH S. HOGGATT, Colonel, USAF
Chief, Personnel Research Division

1 Atch
Survey

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INSTRUCTIONS TO 702X0 SUPERVISORS - 702X0 OJT SURVEY

The accompanying survey is part of a research effort directed toward evaluating the costs and benefits of "On the Job Training." Your cooperation in completing the survey is requested. While it will probably take only an hour of your time, the information you provide will be very valuable to the research and will help to improve Air Force policies concerning OJT and Technical Training School.

If you do not quite understand a question, give the best answer you can and feel free to write in an explanatory comment next to the question or on the back of the form. If you are completely uncertain about what a question means, enter a "?". If a question, for some reason, does not apply to your unit, enter "N.A."

The survey is divided into three parts: A, B, and C. Part A asks you to try to make the best estimates you can about your average experience. Part B asks about what actually happened to specific personnel last week. Try to make sure that you give answers for what really happened, even if it was not a representative week. If you feel that the week you reported on gives a bad picture of your operation, so indicate by writing in an appropriate comment; and if you can, indicate what the average value ought to be in your judgment.

Part C asks you to keep a record of activities, each day for a week. It is important that you do this daily, so that what was actually done is fresh in everyone's mind. If you also feel that the week you reported on is not representative of your normal operations, so indicate by writing in an appropriate comment; and if you can, indicate what the average value ought to be in your judgment.

If you have any questions, contact Capt Dunham, Autovon 473-4106.

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SPECIAL INSTRUCTIONS

1. The trainee's supervisor should complete this suvey. Approx-mately one (1) hour will be required to complete Parts A and B.

2. When answering the questions, be sure to have a Job Proficiency Guide (STS), and the Consolidated Training Record AF-623 for each person undergoing training, handy to refer io.

3. The person who fills out this survey is encouraged to ask for the help of others, such as the OJT Monitor or an instructor when uncertain about the answer to a question.

4. Parts A and B, which should be completed immediately, are to be returned together with Part C within 8 days. Do not start Part C before completing Parts A & B.

5. If there is difficulty in deciding what information is being asked for in any question, contact Capt Dunham, Autovon 473-4106.

BACKGROUND INFORMATION

NAME _____
(Last, first, middle initial)

GRADE _____

Organization _____

Total Months at Present Base _____

Job Title _____

Social Security Number _____

Base or Installation _____

Total Months in Present Job _____

Duty Telephone Extension _____

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PART A

1. What is the total number of personnel in your Administration Section (officer, enlisted, and civilian)?

☐☐ no. of pers.

2. When a man (or woman) first arrives at your office directly from Basic Military Training, it may take some time before he actually begins training and work, even though his "date of entry" to training may be the same as his reporting date. This delay may be due to personnel processing, the need to wait for security clearance, or some other cause. Approximately how many days does it take before the newly arrived "helper" actually begins OJT?

☐☐ work days

3. There is also delay in entering training associated with the arrival of a 3 level from Technical School. In addition to personnel processing, familarization with procedures specific to your office may be necessary before he/she actually begins 5 level training. On the average, this delay is:

☐☐ work days

4. Due to the "minimum time" requirement to the 3 level, delays in paperwork, and delays in completing the Career Development Course, there is sometimes a difference between time of award of the 3 level and the actual time the trainee takes to reach the required level of proficiency in all skills necessary in your section. Based on your experience, what is the average number of weeks it actually takes for a "helper" to reach the proficiency required for a 3 level in your section?

☐☐ weeks

5. On the average, how many weeks elapse between achievement of 3 level proficiency and actual award of the 3 skill level?

☐ weeks

6. How many trainees do you have upgrading to the 3 and 5 level in your section?

☐ 3 level trainees ☐ 5 level trainees

7. In addition to the trainees you now have responsibility for and ignoring the limit on authorized number of personnel, how many more 3 level trainees could your office train right now without significantly reducing the effectiveness of section operations?

☐ 3 level trainees

8. If you had to lose a qualified 5 level (70250) for each new 3 level trainee ("helper"), how many more 3 level trainees could your unit train right now without significantly reducing the effectiveness of section operations?

☐ 3 level trainees

9. If you stopped doing OJT training could your section continue to perform its mission with fewer qualified personnel?

☐ yes ☐ no

How many less?

☐ personnel

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Part A (cont'd)

10. If you lost your 3 level trainees, would you need additional personnel to do the productive work now being performed by the trainees? ☐ Yes ☐ No

11. The newly arrived Tech School-trained 3 level is not as productive at first as the OJT-trained 3 level is, although he may soon close the gap.

a. In your estimate, what percentage of the workload of an OJT-trained 3 level can the Tech School graduate handle immediately after his arrival? ☐☐ Percent

b. How many weeks does it take before the Tech School-trained 3 level works with as little supervision as an OJT-trained 3 level? ☐ Weeks

c. After both types of 3 levels are awarded their 5 level, on the average do you consider either to have superior performance? ☐ Yes ☐ No

d. If your answer was "yes," which type of 3 level do you consider to have better performance? ☐ OJT ☐ Tech Schl.

12. If extra (remedial) training is conducted in your office for trainees who fail the End of Course Test (Apprentice Knowledge Test), answer the following questions:

a. In your experience, what percent of the 3 level trainees fail the End of Course Test the first time they take it? ☐☐ Percent

b. On the average, how many weeks of additional training are given to airmen who fail the End of Course test before they take the test again? ☐ Weeks

c. How many hours per week, excluding overtime, does the trainee spend engaged in this remedial training? ☐☐ Hrs./wk.

d. How many hours per week, excluding overtime, does the instructor (trainer) spend conducting this extra training? ☐☐ Hrs./wk.

13. During the training period for 3 level OJT, the instructor (trainer) must spend some time keeping training records up to date. On the average over the whole training period, how many hours (or fractions of hours) per week does the instructor (trainer) spend in record keeping for one trainee? ☐☐ Hrs./wk.

14. Assuming that your unit had to train the sum of questions 7 and 8, list the number of instructors in each grade who would be responsible for 3 and 5 level OJT: ☐ E-3 ☐ E-4 ☐ E-5 ☐ E-6 ☐ E-7

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Part A (cont'd)

15. In this question, you are asked to provide estimates of training time spent on various items in the Job Proficiency Guide (STS). The figures which you give will necessarily be average figures based on your experience. When you lack experience or cannot recall enough information to properly answer any part of this question, you are encouraged to consult with others in your office who would have more recent experience or who have been in closer contact with the training. Referral to a Job Proficiency Guide (or Specialty Training Standard) will help you give accurate information. If you refer to the following items, you will see that training time to 3 level proficiency for each skill is broken down into categories defined as follows:

Weeks to 3 Level Proficiency: The number of weeks it takes to reach 3 level proficiency in that skill.

Trainee Hours per Week Reading: This is the average number of hours per week during the weeks spent becoming proficient in this skill that the trainee spends reading material relevant to this skill.

Trainee Hours per Week OJT: During the time spent learning this item, this is the number of hours per week the trainee spends learning the different aspects of this skill, in addition to reading.

Instructor Hours per Week: During the weeks spent by the trainee in learning this skill or knowledge, this is the number of hours per week spent by the instructor(trainer)in teaching (or lecturing)all trainees. This may differ from "Trainee Hours per Week OJT" in some cases, such as typing.

Trainees per instructor: This is the average number of trainees handled by an instructor for a particular skill. This may be the same for all skills, but not necessarily.

As an example, look at the first item, "Administration Career Field Progression." If the trainee receives work experience or training in this subject matter in your unit you would mark "X" in the first column. We'll assume that out of the weeks spent by the "helper" in acquiring 3 level skill, in only one week was there formal training about "Administration Career Field Progression." So you would put a '1' next to "Administration Career Field Progression" under "Weeks to Proficiency." This is not an extensive subject, so probably not much time is spent on it. For the sake of an example, we'll say that for the whole week the average trainee spends one hour reading and receives two hours of explanation on the "Administration Career Field Progression." So you would put a '1' under "Trainee Hours per Week Reading" and '2' under "Trainee Hours per Week OJT." We will also assume that the instructor was with the trainee(s) for their two hours of OJT and that he usually handles two trainees while teaching the item. So you would put a '2' beside "Administrative Career Field Progression" under "Instructor Hours per Week" and a '2' under "Trainees per Instructor."

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Part A (cont'd)

The Information for this item would look like this:

	Receives experience In your unit	Weeks to Proficiency	Trainee Hours per week Reading	Trainee Hours per week OJT	Instructor Hours per Week	Trainees per Instructor
Administration Career Field Progression	X	1	1	2	2	2

Again, it is understood that these figures are not exact. Just give the best estimates you can about these average times.

	Receives experience In your unit	Weeks to Proficiency	Trainee Hours per week Reading	Trainee Hours per week OJT	Instructor Hours per Week	Trainees per Instructor
Administration Career Field Progression						
Communications Security						
Supervision & Training						
Office Practices & Equipment Operation						
Publications Management						
Reproduction & Forms Management						
Administration Communications Management.						
Documentation Management						
Library Services						
Postal & Courier Services						

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16. Based on your experience and, if you feel you need help, the experience of other qualified personnel in your office, list the average number of productive and non-productive hours of work for the trainee upgrading to the 3 level for each week between start of training and award of skill level. For instance, in the fourth week of training your trainee spent approximately 30 hours receiving instruction and reading and 10 hours doing productive work. Your second entry would look like this:

4	10	30

Note that the hours for each week must sum to 40.

Weeks of Training (to the 3-level)	Trainee Productive Hours per Week	Instruction & Reading Hours per Week
1		
4		
8		
12		
16		
20		

17. For every 702X0 enlisted grade through E5 in your office for whom you have an AF623 on file, provide the following information (if available):

Social Sec. Number	AQE Score Mech.	Admn.	Gen.	Elect.	Educ. Level	Date Entered 3 skill Training Day/Mth	Date AFSC Award Day/Mth	Method of Training (Check one) OJT	T.Schl

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PART B

THE FOLLOWING QUESTIONS APPLY TO LAST WEEK ONLY. GIVE SEPARATE ANSWERS TO THE QUESTIONS FOR EACH INDIVIDUAL RECEIVING OJT TO THE 3 LEVEL IN AFSC 702X0. KEEP THE ANSWERS FOR EACH PERSON IN A SINGLE COLUMN.

		(Individual) A	B	C	
18.	What week of training is each now in?	☐☐	☐☐	☐☐	week
19.	What % of the 3 level proficiency training do you estimate each has completed?	☐☐	☐☐	☐☐	%
20.	When they arrived at your office, what % of the duties of a 3 level in your section could each complete?	☐☐	☐☐	☐☐	%
21.	If there was any delay in starting their training, indicate how many days for each.	☐☐	☐☐	☐☐	days
22.	How many hours of instruction did each receive last week?	☐☐	☐☐	☐☐	hours
23.	How many hours of Instructor time was spent last week in training all of them?		☐☐		hours
24.	How many hours was spent last week in keeping training records for all of them?		☐☐		hours

25. List the number of instructors in each grade who conducted OJT to the 3 level last week for AFSC 702X0.

☐ E-3 ☐ E-4 ☐ E-5 ☐ E-6 ☐ E-7

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PART B (cont'd)

THE FOLLOWING QUESTIONS APPLY TO LAST WEEK ONLY. GIVE SEPARATE ANSWERS TO THE QUESTIONS FOR EACH INDIVIDUAL RECEIVING OJT TO THE 5 LEVEL IN AFSC 702X0. KEEP THE ANSWERS FOR EACH PERSON IN A SINGLE COLUMN.

		(Individual) D	E	F	
26.	If there was any delay in starting their training to the 5 level because of personnel processing, familiarization with procedures, etc., indicate the number of work days of delay for each.	☐☐	☐☐	☐☐	days
27.	The newly arrived Tech School trained 3 level may not be as productive at first as the OJT trained 3 level is, although he may soon close the gap. What % of the workload of an OJT trained 3 level could each of the Tech School graduates handle after their arrival?	☐☐	☐☐	☐☐	%
28.	How many weeks after arrival on station did it take before the Tech School trained 3 level delivered performance equal to that of an OJT trained 3 level?	☐☐	☐☐	☐☐	weeks

YOU HAVE NOW COMPLETED PARTS A & B.

PART C WILL REQUIRE YOUR KEEPING A RECORD FOR ONE WEEK ON A DAILY BASIS.

PLEASE LOOK AT IT NOW.

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PART C

FOR ONE WEEK PLEASE KEEP A RECORD AT THE END OF EACH DAY OF THE AMOUNT OF TIME SPENT IN EACH CATEGORY.

29. Date started keeping records for Part C — Day ☐☐ Month ☐☐

30. How many DDA airmen do you current have in OJT to the 3 level for AFSC 702X0? ☐☐ Airmen

31. How many total hours did all your 3 level trainees spend on reading and receiving instruction each day?

Mon	Tues	Wed	Thur	Fri
☐☐	☐☐	☐☐	☐☐	☐☐

32. How many total hours did all your 3 level trainees spend in activities contributing to office productivity?

☐☐	☐☐	☐☐	☐☐	☐☐

33. How many total hours of instruction were provided by each grade of instructor?

☐☐	☐☐	☐☐	☐☐	☐☐
☐☐	☐☐	☐☐	☐☐	☐☐
☐☐	☐☐	☐☐	☐☐	☐☐
☐☐	☐☐	☐☐	☐☐	☐☐
☐☐	☐☐	☐☐	☐☐	☐☐

AFTER YOU HAVE COMPLETED THE ENTRIES FOR FIVE DAYS RETURN THE SURVEY TO YOUR BASE CBPO.

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APPENDIX 6: DISCUSSION OF THE COST MODELS

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The cost of trainee time is a major cost element and 6 different models were explored in estimating trainee time:

- Model 1 uses question 15 for its source for the duration and intensity of training time. Question 15 asks the respondent to breakdown his estimates by 10 skill areas. It is probably very difficult for the respondents to make these judgments because most of the estimates are relatively small, and because there is no total to provide a guideline for the overall effort.

While this detailed information may be of interest in studying the nature of the training experience, on balance, it is probably not the best way to obtain cost data because of the relatively high coefficient of variation in the resultant model.

- Model 2 utilizes question 16 for its source of intensity of effort and question 17 for its source of duration. Question 17 is generated by the respondent from written records, and is probably the best source of duration data. However, question 16 over-estimates the intensity of effort, because many respondents misinterpreted the instructions and did not complete their entries in the later weeks, where training effort would have been reduced. This model, therefore, contains a definite bias on the high side for this set of survey data.

- Model 3 uses question 16 and contains the same bias as Model 2. It also uses question 4 to estimate duration, which has a partially counteracting bias on the low side. With two sources of known bias it is a very poor model.

- Model 12 has a very high coefficient of variation because it is based on questions 18 and 19, which, in turn, have high variance. There is also possible bias because some respondents misinterpreted the relationship between question 19 and 20.

- Model 21 was based on question 4 which has a very significant low-side bias.

- Model 24 is the best of the training time models since its sources of duration and intensity data, questions 17 and 31, are the best estimates of these parameters. In the future the Uniform Airman Record should be utilized to provide the duration data in order to generate larger sample sizes, and reduce questionnaire complexity.

Three models were explored for estimating the <u>cost of instructor time</u>:

- Model 4 has the sample problems as trainee time Model 1. That is, it is based on question 15. It has low-side bias and a high coefficient of variation.

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- Model 13 also has a high coefficient of variation, and the same possible biases in respondent misinterpretation discussed in Model 12.

- Model 23 has the minimum coefficient of variation of the three models and no suspected biases. Like Model 24 it is based on Question 17 (a written record, for duration information), it utilizes question 33 for intensity information which provides an actual weighting of hours and grade; and it has a low coefficient of variation for the estimate of hours per trainee.

Two models were investigated for estimating the cost of delayed entry to training:

- Model 6 is more efficient than Model 14; that is, it has a lower coefficient of variation. Both are very simple models, but 6 was based on a single answer to Question 2, whereas 14 was based on the more complex response to Question 21.

Two models were also investigated for estimating the cost of records management time.

- Model 15 has a slightly lower coefficient of variation than Model 5. Both models have some high-side bias because of responses to questions 13 and 24, although the absolute amounts are small.

Two models were also investigated for Tech School Equivalency and Tech School Delay costs, respectively.

- Model 9 was judged superior to Model 16 for the same reasons Model 6 was judged superior to Model 14; i.e., inherent simplicity and lower variability in response.

- Model 8 was judged better than Model 17 because Model 17 had a very high coefficient of variation. Model 8 also employs the better estimates of resource utilization (Models 23 and 24) as inputs, and would, on those grounds, also be more acceptable.

Only one model was used to estimate Remedial Training Time cost:

- Model 7 is very small in absolute value. It was based on the response to question 12 which was the only question used to collect the basic inputs.

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APPENDIX 7: SELECTION OF AN OPTIMAL OJT/TTS MIX

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Due to the developmental nature of OJT costing research, much of this report is devoted to a discussion of different aspects of the costing methodologies. However, for purposes of OJT and TTS comparisons, factors in addition to OJT costs need to be considered as criteria for the selection of an optimal OJT/TTS mix. Comments from several sources indicate that the importance of these other criteria needs more emphasis to place the cost comparison in proper perspective. This APPENDIX expands upon points made in the basic study to emphasize the limitations of dollar cost estimates of OJT and TTS as the sole criterion in establishing the number of non-prior service airmen sent to resident TTS and the number sent DDA, i.e., OJT.

As indicated above and in an earlier report (Dunham, 1972), the cost of OJT is substantially less than TTS costs for AFSC's 291X0, Communication Center Operations Specialist and 702X0, Administrative Specialist for training to the 3-level. A conclusion, which might be inferred from a cursory examination of these costs is that the Air Force should send as many men as possible to OJT in these specialties. However, as explained previously, (Dunham, 1972, p. 9):

> "...the results are not justification for discontinuing the technical school course for Communications Center Operations. The data do suggest that the Air Force should send as many personnel as possible to OJT in this particular skill, although the exact number or percentage of the training requirement who should upgrade through OJT is not specified.
>
> There are five criteria relevant to determining an optimal mix of OJT and technical school training in any Air Force specialty:
>
> 1. Cost of technical school training
> 2. Cost of on-the-job training
> 3. Quality of training methods
> 4. Capacity of training methods
> 5. Personnel assignment system constraints"

The OJT/TTS mix may affect the quality of trained airmen, the time necessary to meet a sudden increase in required operational capability, and the ability of units to maintain their operational effectiveness. Also, there are a number of non-quantifiable factors which include inadequate measures of productivity. The opportunity or alternative cost of any training is the value of the productivity lost (if any) as a consequence of conducting the training. Unfortunately, we have only crude methods of determining productivity and for estimating its value. Quite often, the Air Force and most other public organizations back up a step in the production process and assume that the value of output must be at least as valuable as the sum of the cost of the inputs

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used in the production process. Hourly wages of instructors and trainees are interpreted as "marginal value products." It is assumed that the Air Force competes for airmen with private industry, and other governmental agencies, and that no elements of monopsony exist in the marketplace. High school graduates are attracted to the employer offering the highest benefits. A zero-draft environment is also assumed. Thus, to measure training cost (i.e., the dollar value of lost productivity), it is usual to determine the time spent by instructors and trainees in training and assume that the value of this time is the corresponding dollar wages. For TTS this time is 40 hours per week; for OJT, something less than 40 hours per week.

This 'productivity lost' cost concept is not new, but it is rarely explicitly mentioned. Another implicit assumption often used is that training costs are linear with respect to training load. At face value, this assumption appears reasonable, particularly with respect to TTS. In TTS, there is often a constant relationship between the number of instructors and the number of trainees, e.g., for every additional twenty to twenty-five trainees, one instructor is added. This step-function is approximated by a linear relationship, when combined with trainee time. However, if an instructor is sent to TTS to increase the number of TTS graduates, this means that a potentially productive NCO is not at an operational unit, thus resulting in at least a temporary diminished productivity at the losing unit.

At times, this is not much of a burden, but the Trained Personnel Requirement (TPR) could easily double or triple without a corresponding change in manning.[1] Under these circumstances, trainer manpower requirement could be inordinately large and cause a strain on the ability of units to maintain the necessary level of productivity or mission accomplishments.

Wages (input costs) are <u>not</u> representative of training costs (productivity losses) under these circumstances. To put it another way, the assumed linear relationship between training load and training costs is <u>not</u> linear when training loads increase rapidly.

The above argument also applies to cost estimates of OJT. Beyond a certain training load, the cost estimates based on wages are underestimates of the productivity loss associated with adding one more trainee. In fact, because of the lower student/instructor ratio feasible for OJT, the relative cost relationships reported for OJT and TTS may reverse under adverse training loads. Manning in the field frequently does not increase with the on-the-job training load. Small operational

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[1]TPR's are very sensitive to variables largely uncontrollable by ATC, e.g., budget cuts, mission changes, and new weapon systems.

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units can only have so many of their qualified 5-levels replaced by DDA 'helpers' before unacceptable productivity losses result. When manning requirements increase rapidly, the 20 or 25 to 1 student/instructor ratio at TTS could make TTS the lower cost method of training.

The current state-of-the-art of productivity measurement does not allow this situation to be incorporated into the cost estimating procedures for TTS and OJT, but there is an alternative method of dealing with the problem.

It has been argued that at some maximum training load the cost advantage for OJT may disappear. Instead of speaking in terms of total training load, we could obtain estimates of the capacity for OJT at given manning levels. Capacity for OJT is defined as the maximum number of personnel who can be in OJT at any point in time without causing "unacceptable"losses in productivity.

OJT capacities need to be obtained for each AFSC under study and could be used to compute upper limits on the number of DDA's who should be sent into the field during any specific time period. Methodologies for estimating OJT capacities need to be developed. The estimation problem is complex, but solvable.

The training capacity problem was identified in the original development of an OJT costing methodology (Dunham, 1972). A minor objective of the 291X0 OJT Survey was to collect OJT capacity data for AFSC 291X0, Communications Center Operations Specialty. Responses to question 9 of the 291X0 survey--

> "9. If you had to lose a qualified 5-level for each new 3-level trainee (helper) how many more 3-level trainees could your Comm Center train right now without significantly reducing the effectiveness of the Telecomm operations?_____3-level trainees"

were combined with Uniform Airman Record data to obtain a rough estimate of the capacity for 3- and 5-level OJT for AFSC 291X0 of 1548. In other words, given the manning standards at the time of the survey (Mar 1970), the maximum number of personnel who could be upgrading to the 3- and 5-level through OJT at any one point in time for AFSC 291X0 was estimated to be 1548.

This capacity estimate has some shortcomings, but it was probably a conservative 'ballpark' estimate for the AFSC. Sending enough personnel DDA to exceed this figure would, in the minds of the supervisors who responded to the survey, "significantly reduce the effectiveness of Telecomm operations."

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From the time of the "291X0 OJT Survey" to the beginning of FY 1973, the manning as expressed by the number of personnel serving in Duty AFSC 291X0 has decreased approximately 24% in CONUS.[1] Since one would expect OJT capacity to vary with manning, a revised capacity estimated would be 1173.

It would be useful to present an example using the above capacity estimate. Table 3 shows the actual number of DDA's and TTS entries sent from the School of Military Sciences—Airmen[2] at Lackland AFB during FY 73 and how these allocations compare against the 'ballpark' OJT capacity estimate of 1173. In November 1972, the number of personnel participating in 3- and 5-level OJT in CONUS is 97% of capacity. The months following November continue to show near-capacity numbers of personnel in OJT, finally exceeding the limit in April 1973.

If these people in OJT to the 3- and 5-level were allocated to the units in a manner designed to minize their detrimental effect on productivity, and if the assumptions for Table 3 (Footnote [2] of that table) hold, the Air Force has satisfied the estimated capacity constraint for most of CY 73. Violation of any of these 'ifs' would probably result in significant productivity losses at the unit level.

Some of the assumptions behind Table 3 are quite tenuous: that is, the capacity estimate is, at best, a rough estimate; more of the TTS graduates may have been assigned in CONUS than the assumed 59.8%[3] of the monthly assignments; some commanders or units may have received a disproportionate percentage of the DDA's.

A simple dollar cost comparison, as pointed out above, does not encompass all of the important criteria. This APPENDIX has discussed only briefly one problem which would occur if the dollar cost comparisons were taken as the only facet of the problem. It is likely that the problem presented can be solved through development of improved capacity estimates combined with improved unit assignment methods.

This APPENDIX is not an exhaustive discussion of the "capacity problem," nor is training capacity the only criteria not quantifiable into dollar costs. Selection of optimal OJT/TTS mixes requires consideration of criteria which have not been mentioned

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[1]CONUS manning was used for the original estimate because non-prior service DDA's generally cannot be sent overseas.

[2]Basic training.

[3]Obtained from Dec 72 UAR, expresses percentage of total DAFSC in CONUS.

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Table 3

Number of 3- and 5-Level Trainees and OJT Capacity[1]

FY 1973

Month	Total Number of Trainees in 3- and 5-Level OJT	Difference From OJT Capacity
July, 1972	597	(+)576
August	613	(+)560
September	633	(+)540
October	903	(+)270
November	1142	(+) 31
December	1143	(+) 30
January, 1973	1105	(+) 68
February	1065	(+)108
March	1154	(+) 19
April	1225	(-) 52
May	Not Available	—
June	Not Available	—

[1]TTS entries and DDA's obtained from ATC P-68, "Disposition Report of Graduate Airmen Receiving Assignments."

[2]Assumes (1) DDA time-to-upgrade to the 5-level is 14 months, while TTS time-to-upgrade to the 5-level is 12 months, and (2) up to 40.2% of the TTS graduates are assigned overseas. Time-to-upgrade information was obtained from CY 1970 data, but should serve for illustrative purposes. More current time-to-upgrade data are now being collected by AFHRL.

here or elsewhere in print. A subsequent TR is in preparation at Manpower and Personnel Systems Division, AFHRL which will go into more detail on a methodology for selecting optimal OJT/TTS mixes

It was the purpose of this APPENDIX to demonstrate the need for more information than just OJT and TTS costs. While costs have an important role, ignoring other criteria could result in a misallocation of resources and subsequent real losses in productivity and Air Force mission accomplishment.